uncertain, but does not appear likely in view of the profound disturbances of coronary anatomy and ventricular function. The fact that many of these patients have mitral regurgitation, however, suggests that vasodilator drugs might be appropriate medical therapy to consider. This is important because the average increase in cardiac output with vasodilator drugs in mitral regurgitation has been in the range of 50 percent.[3]

The data on ventricular function indicate that some measurements of resting hemodynamics, such as cardiac output, may be within the normal range. Furthermore, only cardiac index was statistically different between those groups with a good and those with a poor subsequent prognosis. Postoperative ventricular function studies, in general, showed no major improvement in hemodynamic function. It should be pointed out, however, that resting measurements of function are often not as revealing as measurements obtained during cardiac stress. Therefore, measurements following some stress, such as that produced by acute hypertension or exercise, would have been preferable in characterizing the ventricular reserve of these patients before and after aneurysmectomy.[4]

Despite little change in hemodynamics postoperatively, many of these patients were symptomatically better. This probably relates to improved ventricular reserve, although this was not specifically tested. In the past, it has been suggested that reduction of wall stress by reduction of heart size due to the Laplace mechanism may improve the function of the remaining normal muscle and, therefore, provide better ventricular reserve. Precise studies on this point are lacking, but it is probably an important factor in the improved exercise capacity that many of these patients exhibit clinically. Relief of ischemia may also play a role, both by reduction of myocardial oxygen demand and also by improved flow to certain areas consequent upon bypass grafting.

The indications for operation have basically not changed over the years. Unfortunately, the long-term prognosis is a very poor one indicative of the severity of the underlying coronary artery disease and ventricular function. The inhospital mortality of 6.6 percent represents excellent surgical results in this group of extremely ill patients. The lack of long-term beneficial effect is disheartening, however, and is similar to the subsequent prognosis of patients who survive power failure following myocardial infarction.[5] Whether interventions such as intraaortic balloon counterpulsation, vasodilator therapy, or mapping and excision of ectopic foci (to eliminate arrhythmias) will modify the development of aneurysms or provide alternative therapy for the associated complications is unclear, but deserves further investigation.

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Special Editorial

Radiology and the Algorithmic Approach to Medicine

THE HIGH EXPENSES for medical care in the United States have caught national attention and have been the subject of numerous newspaper articles, editorials and television spectaculars. Although the Gross National Product (GNP) of the United States has risen dramatically in the last two and a half years, the cost of medical care has been increasing even faster, almost doubling its percentage of the GNP since 1950 and reaching a level close to \$140 billion in 1976.[1] This amounts to almost 10 percent of the income of every American. These expenditures continue to rise at a pace double that of inflation. Many factors contribute to this: increases in wages, in personnel fringe benefits, in building costs and, among others, in the cost of advances in technology. Physicians' fees have kept pace with the general rise of health service expenditures, staying at a level of about 20 percent of the total for the last 15 years.[2]

In the last ten years there has occurred an explosive growth of medical technology, due in great part to the spillover from space technology and spurred on by the retrenchment of that program. This later development freed many physicists and engineers to apply their talents and experience to the field of medicine. The advances have been most impressive in the application of computers to nuclear medicine and diagnostic roentgenology, as well as in ultrasonography—where the development of the gray scale B mode has greatly improved the diagnostic capabilities of this method. The dramatic developments in computed tomography (CT) simultaneously have aroused the imagination of the public, the interest of physicians, the wrath of health planners, and the enthusiasm of lay hospital boards (many of whom saw in these sophisticated machines a way of filling the beds of their institutions at the expense of the less swiftly moving neighboring hospitals). This has resulted in rapid proliferation of CT scanners, an event that regional regulating agencies have only slowed down. Yet CT scanners are just one of the expensive modalities in equipment in a radiology department today. Biplane angiographic machines cost as much as CT body scanners, and the cost of the whole array of equipment in radiology departments, when ultrasound and nuclear medicine machines are included, is four to five times greater than ten years ago.

Because it is unlikely that the increased sophistication and cost of equipment have resulted in a proportional improvement in health care, it is understandable why agencies regulating medical care are alarmed. The United States economy will have difficulty supporting a continued rapid increase in medical care expenditures. Yet it can be predicted that the American public will not willingly give up the advances in medical care. It is almost impossible to cut the cost of medical services to any great extent without radically changing our social and economic ways; it is imperative, therefore, to render economies by increasing efficiency and eliminating unnecessary procedures. Because diagnostic workups frequently involve duplication and costly traditional routine steps, and represent a large part of the expenditures, an algorithmic rational approach to diagnostic workups is one of the few alternatives left to the medical profession.

The term algorithm used in this frame of reference means a set of rules for obtaining a specific output from a specific input. When these rules are followed, each step in the sequence logically leads to the next. In order to employ radiological

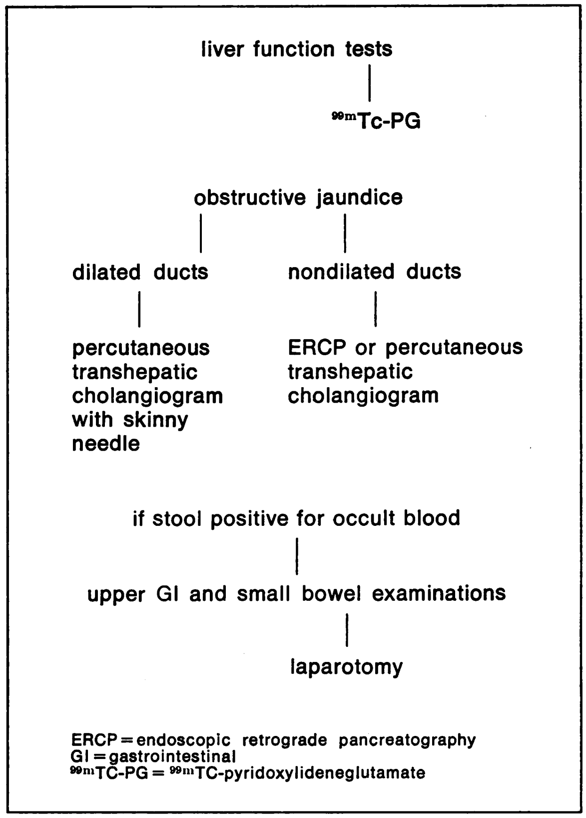

Figure 1.—An algorithm for the radiologic approach to the evaluation of obstructive jaundice (see text for explanation).

procedures in a logical and efficient way radiologists and their clinical colleagues *must* jointly develop a set of algorithms that will guide the diagnostic workups of their patients. In the orderly progression of these diagnostic tests, the examinations to be carried out will be based on the results of those preceding them. It is important that these algorithms be reviewed frequently and changed when experience and newer advances dictate. Radiologists and clinicians, and in teaching hospitals they and the house staff, should meet during the progress of workups of their patients and jointly apply the algorithms and deviate from them, if necessary, only after discussion. Hospital patient care committees should make sure that such algorithms are in existence, that physicians are familiar with them, and that deviations are not based on the capricious prejudices of prima donnas.

Examples of Algorithms

An algorithm for the radiologic approach to the evaluation and diagnosis of obstructive jaundice is shown in Figure 1.[3] It is applicable only to large institutions that have CT and ultrasonographic equipment. Ultrasound is usually the best, fastest and least expensive approach for showing dilated bile ducts. In the presence of ascites, or large amounts of intestinal gas, CT scanning is more reliable. This latter method, however, is of less value than ultrasonography in cachectic patients because CT scanning depends on the presence of intraabdominal fat to outline the organs and masses. Endoscopic retrograde pancreatography (ERCP) may be employed as an alternative to percutaneous transhepatic cholangiography with a skinny needle when the biliary radicles are shown by CT or ultrasonography to be normal, or when it is important to study the pancreatic ducts. If no skillful endoscopists are available, percutaneous transhepatic cholangiography should still be attempted; it has been shown to be increasingly successful even with nondilated ducts. The upper gastrointestinal barium sulfate examinations should be carried out only if tests of stool specimens for occult blood are positive, in order to uncover invasion of the duodenum.

An algorithm for the diagnosis of an upper central abdominal mass is shown in Figure 2.[4] The plain film examination should be the initial radiologic step. In those patients with signs of infection a gallium scan should be done to locate an abscess. Upper gastrointestinal and small bowel examinations, as well as a colon examination, should be carried out. Ultrasound and CT examinations are indicated in these patients. Ultrasound, though offering less detail, has the advantage of parasagittal as well as transverse scans and should be used as a localizing procedure that may obviate the need for a CT scan. Arteriography, which until recently was regularly done in the workup of such patients, should now be done to study only vascular lesions.

An algorithm for the diagnosis of massive rectal bleeding is shown in Figure 3.[5-7] This algorithm is not controversial, but because patients with this condition usually present as acute emer-

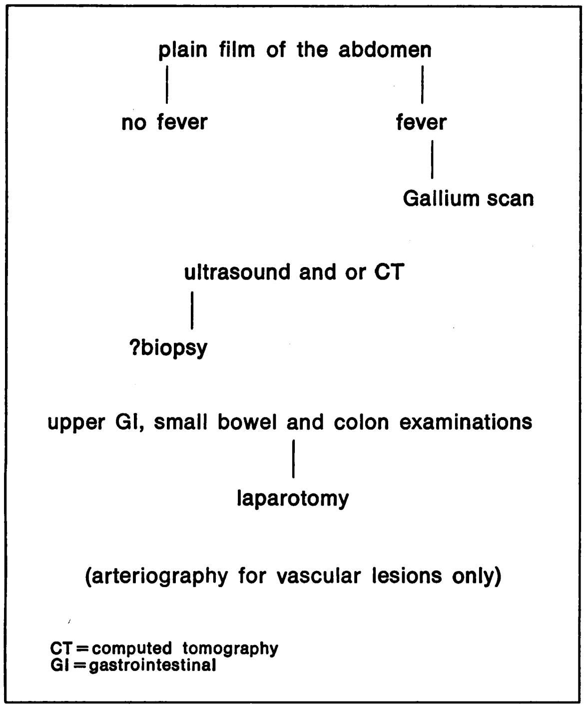

Figure 2.—An algorithm for the diagnosis of an upper central abdominal mass (see text).

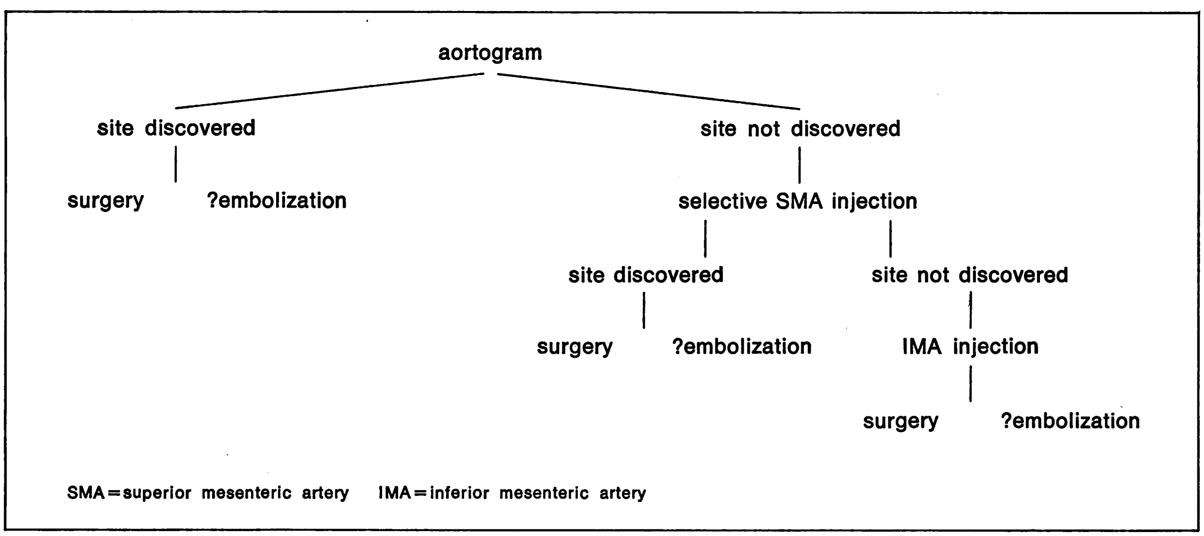

Figure 3.—An algorithm for the diagnosis of massive rectal bleeding (see text).

gencies it is important to have this approach as a guide for expeditious and prompt handling.

If physicians, surgeons and radiologists do not develop and employ a logical set of diagnostic workup procedures, nonmedical administrators will impose rules on them that will be far less informed and less flexible, and will not serve their patients well.

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Editorial Essay

Where Is Mandatory CME Taking Us?

"WHERE IS MANDATORY CME TAKING US?" Now that continuing medical education has become mandatory in many places in the United States, it would seem incumbent upon medical educators to make mandatory CME a useful experience for physicians and a response which will satisfy the public demand for assurance of quality in patient care. These are times of increasing emphasis on public accountability in virtually every aspect of patient care, and if this cannot be accomplished through mandatory CME to the satisfaction of the public, then one may be sure that some other approach will be mandated. Since other approaches are likely to be more difficult and possibly less consistent with what physicians are doing, or ought to be doing in their practice situation, it would seem that this is compelling enough reason to make mandatory CME work.

What is it the public wants? It seems that the public wants some kind of assurance that physicians are competent to do whatever it is they are supposed to do in their practices. Unfortunately there is enough evidence that enough physicians are falling short to have brought about this demand for quality assurance on the part of the public.

The logic of mandatory CME to assure continuing physician competence seems obvious enough. Originally physicians were held to be competent to be licensed after having gone through an educational process in medical school followed by an internship and an examination acceptable to a state licensing board. Later physicians were held to be competent in a specialty after further education and further examination by a specialty board. It therefore seems logical enough to assume that if education made physicians competent in the first place then continuing medical education should assure continuing competence. This seems to be the rationale upon which mandatory CME is based and it is this assumption which we must show to be valid if mandatory CME is to work.

Now where do CME educators find themselves?

1. CME educators have committed themselves to the idea that CME works to improve patient care—that is, patient care outcomes. It certainly does this. Physicians continue to learn. Physicians do not continue to practice as they did when graduated from medical school or specialty training many years earlier. They must have learned something as they have gone along and this by definition would be CME. This is an article of faith.

2. It has frequently been said it is generally the good doctors who do formal CME, and that the problem has been that those who really need CME are not the ones who have gotten most of it.

3. These words have now been heard and some 20 states have legislated the tool of mandatory CME. In a way there is now a challenge to see if CME can be made to work to assure continuing competence. It is in a sense up to CME educators to prove that it can.

4. Over the years doctrine has developed somewhat as follows:

- The purpose of CME is to improve patient care, morbidity and mortality, and presumably it does;
- CME programs should be developed on sound educational principles;